NOAA NATIONAL DATA CENTER CLIMATE DATA ONLINE FOR USE IN RESEARCH, APPLICATIONS, AND EDUCATION

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Introduction

During 1998-1999, the National Climatic Data Center developed the NOAA National Data Center Climate Data Online (NNDC CDO) System to a) provide fast, easy online access to a variety of climatic datasets; b) provide the climatic support and backbone for the NNDC Server; and c) facilitate migration from a Unisys mainframe customer support environment to an open systems unix environment.

This system includes both recent and historical data, useful for studies of particular weather events, and for historical analysis of data for statistical and other research purposes. The types of data currently included in the system, which continues to be populated, are surface daily and monthly data, hourly precipitation data, and 15-minute precipitation data. The data are primarily for the United States, although there are two monthly datasets, one of which includes global stations. The system will be greatly expanded over the next year, with global surface hourly and global upper air data to be added. The system URL is: http://www5.ncdc.noaa.gov:7777/plclimprod/plsql/poemain.poe.

The NNDC CDO backbone is an Oracle relational database system, using structured query language and other programming languages to retrieve data. Data are accessible and selectable by region, country, state (US), county (US), climate division (US), and station, and by time period (year, month, day, hour). The data are available free of charge to National Oceanic and Atmospheric Administration (NOAA) users and to U.S. educational institutions, with charges applied for other users. However, charges are greatly reduced as compared to traditional off-line delivery of climatic data. This paper describes the system, its application for various studies and climatologies, and specific use of the system to evaluate a weather event.

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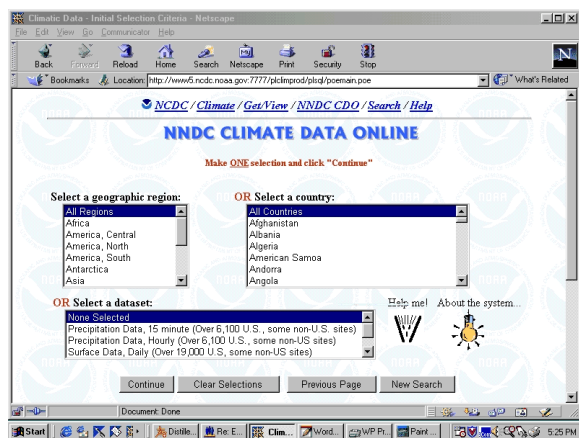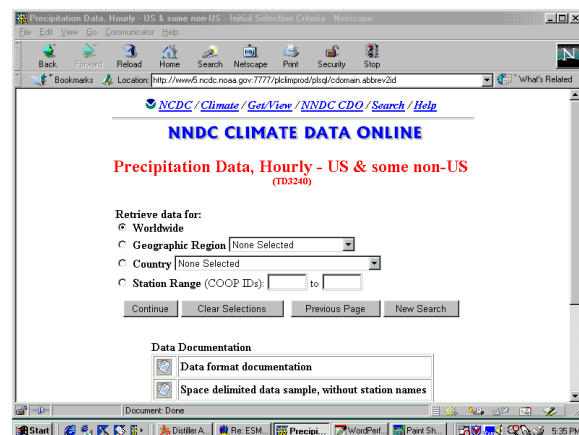
Discussion

The climatic data currently accessible are:

- Daily (primarily U.S.) for full period of digital record, typically 1948 to present, over 19,000 stations historically, over 8000 currently active.
- Monthly (primarily U.S.) for full period of digital record, typically 1948 to present, over 19,000 stations historically, over 8000 currently active.
- Global monthly for 1987 to present, over 3000 stations historically, over 1000 currently active.
- Hourly precipitation (primarily U.S.) for full period of digital record, typically 1948 to present, over 6000 stations historically, over 2800 currently active.
- 15-minute precipitation (primarily U.S.) for full period of digital record, typically 1971 to present, over 3400 stations historically, over 2400 currently active.

The main user interface (Figure 1) allows initial selection by region, by country, or by data type. So you can select, for example, one country to see the types of data available for that country. Or, you can select one data type to see which countries and stations have data available for that type of data.

The next "page" (Figure 2) allows selection of the entire dataset ('worldwide'), selection by region, by country, or by station number range. Selection of United States as the country then leads to an interface (Figure 3) allowing selection by entire state, climate division, county, or individual station(s). This is quite flexible in that you can select, for example, all stations in a county, or just pick selected stations from a particular state.
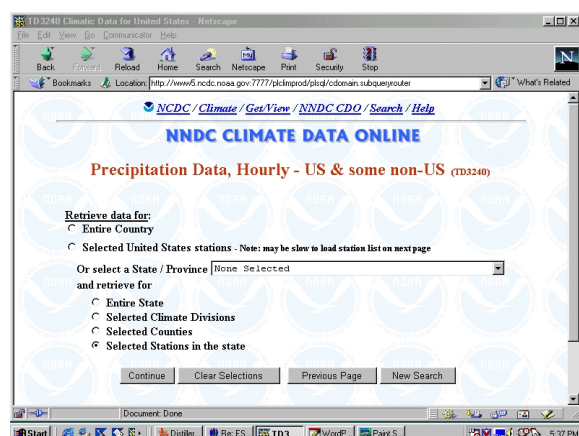
Figure 1

The next "page" will vary depending on what you selected so far. For example, if you choose "climate division" as your criteria, you'll then see a map of the divisions for that state (Figure 4). If you choose "county" as your criteria, you'll see a list of counties (Figure 5). If you choose station as your criteria, you'll see a full list of stations for the state (Figure 6).
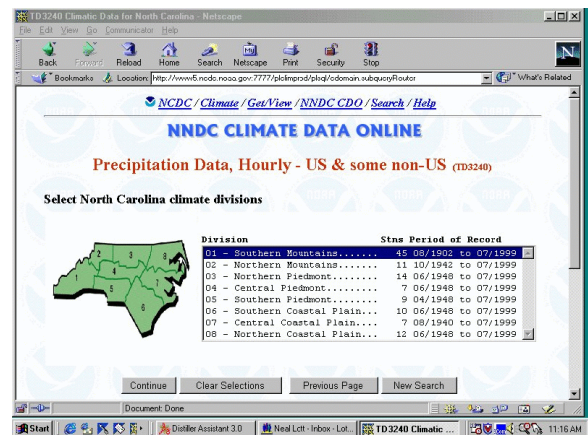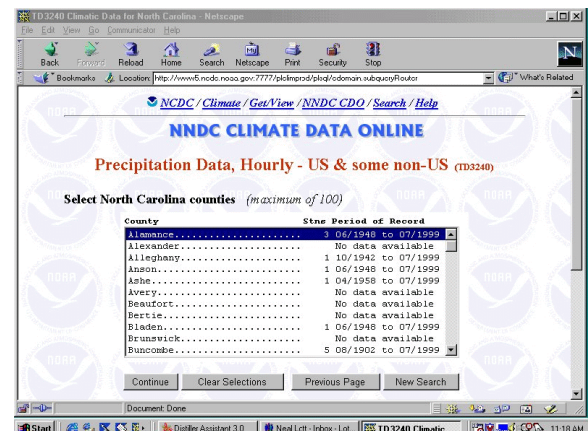
Figure 2

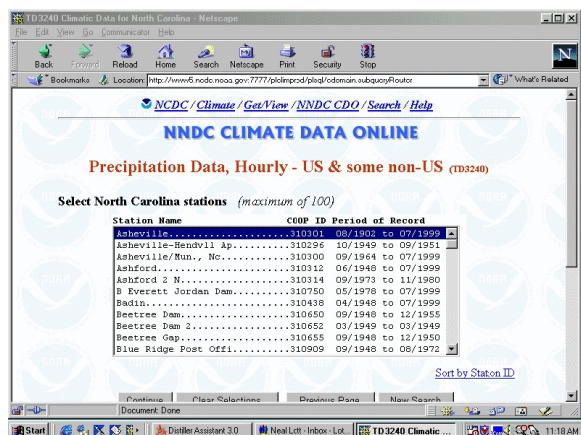**Figure 4**

Figure 3

Figure 5

Figure 6

The next "page" (Figure 7) then provides for selection of the period/dates you require and the output format desired. Also, some datasets (e.g., daily, monthly) provide element selection capability on this page, so that you can select just the desired weather elements (e.g., precipitation, temperature). Our basic format options (for most datasets) are:

Space-delimited with station name in each data record
Space-delimited without station name
Comma-delimited with station name in each data record
Comma-delimited without station name
The standard (archive) variable length format for that particular dataset
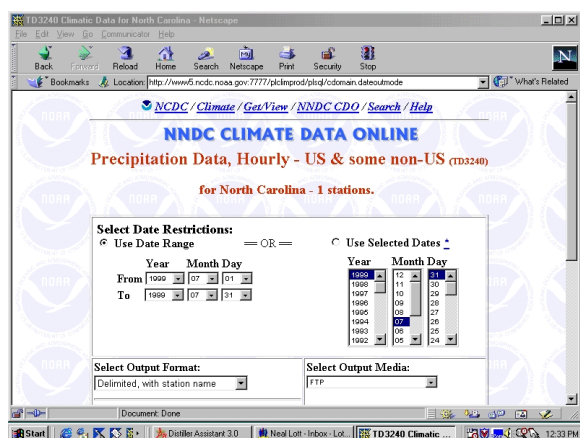The standard fixed length format for that particular dataset

Figure 7

Most users prefer one of the delimited formats. Comma-delimited is often better for import into a spreadsheet. Space-delimited is easier on the eyes and easy to write a program for, such as with Fortran or C++. The standard dataset formats are often required by users with application programs previously written for those specific NCDC formats.

The next "page" will provide a summary of your request and will then direct you into our Online Store, unless you have free access as mentioned above. The Online Store then requests payment information, with a similar interface as you would see for other online systems. At present, payment by credit card is the only option, but we plan to add a subscription option, whereby users will be able to subscribe to the system for a year at a fixed price.

Finally, you're directed to an html address with a list of files that have been produced, or are being produced. Your data file may already be available, so you can click on the file to see if it's there. If not, just bookmark the page for future reference. Also, you're "double-covered" in that we send you an email with directions to your data when your order has finished processing. You'll have access to the data file, an inventory for your selection, a station list, and data format documentation. Most small orders (e.g, a few mb) complete processing in a few minutes. However, some larger orders require a few hours to process, so keep that in mind after placing your order. Of course, if our system is quite busy, run times will be longer; and if the internet "lines" in your path to NCDC are busy, your time required to ftp the data files will be longer.

A complete help system is included (http://www5.ncdc.noaa.gov/cdo/info.html) with a data price schedule, general system information, detailed system help for diagnosing problems (e.g., inability to connect due to firewall on user end), format documentation, data samples, station lists, utility software, etc.

An Application

The January 1998 ice storm was a memorable one for the northeastern U.S. and southeastern Canada. Precipitation amounts approached 100 mm in some locations, mostly in the form of freezing rain. Overall damages for the area were in the $2-3 billion range.

Let's say you wanted to look over the precipitation amounts for the state of Maine for this event. You can use NNDC CDO to select the daily dataset. Select the state of Maine and the month of January 1998, for the climatic element precipitation. If you desire to load the data into a spreadsheet, the comma-delimited format is the best option.

We ran this data selection and received a data file. We then loaded the data into a spreadsheet (MS Excel) and removed any columns not needed. In this case, we removed columns containing days other than January 5-10 – the period for the ice storm. Since data are reported and stored in hundredths of inches for each day, we added two columns to the table–one for a summation of days 5 to 10, and the other column for the same summation converted to millimeters.

The results are shown below for amounts exceeding three inches. The highest reported precipitation amount occurred in Eustis with 3.78" for the event.

January 5-10, 1998 Precipitation in Maine
Summation (sum) in hundredths of inches, and converted to whole millimeters (mm)

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Location              Sum    Sum
                   (inches) (mm)

EUSTIS               3.78    96
DANFORTH             3.63    92
WOODLAND             3.56    90
ROBBINSTON           3.47    88
ACADIA NATL PARK     3.43    87
PATTEN 2             3.40    86
RANGELEY 2 NW        3.38    86
BARNARD              3.33    85
GRAND LAKE STREAM    3.32    84
GUILFORD             3.32    84
BRIDGEWATER          3.31    84
PITTSTON FARM        3.31    84
VANCEBORO 2          3.31    84
FRYEBURG             3.28    83
NEW SHARON           3.27    83
JACKMAN              3.25    83
BRASSUA DAM          3.24    82
HARMONY              3.18    81
HOULTON 5 N          3.18    81
SEBEC LAKE           3.18    81
RANGELEY             3.17    81
MIDDLE DAM           3.16    80
CORINNA              3.15    80
MILLINOCKET          3.15    80
HOULTON INTL APT     3.14    80
LONG FALLS DAM       3.10    79
MOOSEHEAD            3.07    78
MACHIAS              3.04    77
CLAYTON LAKE         3.02    77
SQUA PAN DAM         3.02    77
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Of course, you can also select other climatic elements such as maximum and minimum temperatures. You could also make use of other datasets to study such an event, such as hourly precipitation. For worldwide applications, other datasets will be added to this system over the next year, including global hourly surface observations (which include precipitation amounts, precipitation type, temperatures, wind direction and speed, and many other types of data), and global upper air observations.

Conclusion

Although with limited publicity, this system has proven to be quite popular since its online implementation in June 1999. Customers for the available datasets are now frequently using this system rather than placing off-line orders by phone for later delivery by mail. However, when off-line orders are placed, NCDC uses NNDC CDO to fill the order and provide the data on the requested media (e.g., CDROM, zip disk, magnetic tape, ftp delivery). This means we only have to maintain one system for both online and off-line support for these datasets, and future datasets that will be added. That translates into substantial cost savings to the government, and to users of the system.

We currently limit the data volume for a specific user-requested file to 40 megabytes (mb), which is then compressed (gzip) to 5 mb or so. We plan to increase that limit in the future, as bandwidth improvements allow. Of course, you can place several orders (i.e., for several files) in one web session to retrieve all of the required data. For the immediate future, we suggest that requirements for large data volumes (over ~ 100 mb) be placed as an off-line order by phone (828-271-4800) or email (orders@ncdc.noaa.gov).

A g a i n ,   t h e   s y s t e m   U R L   i s: http://www5.ncdc.noaa.gov:7777/plclimprod/plsql/poemain.poe. We encourage you to give it a try and provide feedback to us. We continue to implement enhancements to the system, with user feedback being a key to that process. Our long-term plan is for this to be NCDC's primary method of delivering in-situ climatic data to customers. The NNDC CDO system is a product of the following development team members: Dawn Anders, Jeff Arnfield, Steve Fleming, Neal Lott, Doug Ross, Tom Whitehurst, and Vickie Wright.